

**DSN Mission Forum – Panel Notes**  
**9 December 2009**

**PANEL: Mission Perspective on DSN**

**Jim Adams (SMD), Chair**  
**Rich Burns (GSFC)**  
**Mark Holdridge (APL)**  
**Todd Holloway (MSFC)**  
**Gentry Lee (JPL)**  
**Marcus Watkins (GSFC)**

The panel taping is broken into two parts P1=60 min and P2=20 min)

<http://realserver1.jpl.nasa.gov:8080/ramgen/vod/av/2009/DSNForum2009-P1-AVC-2009-221.rv>  
<http://realserver1.jpl.nasa.gov:8080/ramgen/vod/av/2009/DSNForum2009-P2-AVC-2009-221.rv>

Jim Adams

Going into the future, we need to find ways we can partner better between missions and the DSN itself. The panel is intended to stimulate a lively discussion and interaction among the participants.

**Opening Remarks**

Jim Adams, NASA HQ, Deputy Director for Planetary Science  
Marcus Watkins – GSFC, former NASA rep to Madrid  
Rich Burns, GSFC SSMO, Deputy Project Manager  
Gentry Lee, JPL, Chief Engineer  
Mark Holdridge, JHU/APL, NHPC Mission Manager  
Todd Holloway, MSFC, Lunar Landers Project

Jim Adams

Recounted partnership between mission and DSN to solve STEREO launch problems with hot signal at launch and resource contention issues with Cassini. We didn't understand the conditions under which the DSN must operate in supporting multiple missions. For eg., DSN would not necessarily know ahead of time which antennas would be supporting the launch and so it was difficult to resolve the problem with temporary attenuators with this uncertainty. For eg., Cassini had a parallel once-in-a-lifetime science event (Saturn image shown) and a trade had to be made. Scheduling was a messy process, and the 'winner' was often those who had hired the toughest "pit bull" scheduler.

These are not easy choices, we have to do it as a partnership, especially if we are to make 2011-2012 happen. It is important to build relationships among the missions and the DSN.

Marcus Watkins

I got to see DSN from a different perspective at MDSCC. GSFC is second only to JPL on the number of DSN missions and there are even more challenges in the future. It will take a lot of communicating and coordinating, especially with scheduling demands, and it will be important for DSN to be up and operating. We need to understand reasons and then support antenna maintenance, since there is an aging infrastructure.

We need to communicate at all levels, from projects to DSN to HQ, so everyone understands requirements of the missions. Flexibility will be essential, even with intense planning and scheduling, things happen.

Challenges are great, but the rewards are great

Rich Burns

Described GSFC missions and their challenges for the future. Scheduling process will need efficiencies in the future. I have been impressed with level of reliability of DSN in their mission support and they generally meet all mission requirements (most SSMO missions are in extended phase). Extended missions have special challenges in staying current with changes, budgets are small and staffing is down significantly. They understand the need for change and like the idea of forming a "marriage" for making decisions on change and how to move forward.

Gentry

From the mission side, there has been little attempt to understand, recognize, and get in the moccasins of the people who provide the DSN services.

Missions should take it upon themselves to understand that without the DSN and its continued growth, they cannot continue to do the job they need to do.

I am looking forward to a new era in which both sides understand each other a little bit better

Mark Holdridge

We had to invent things on our own with the NEAR mission at APL, new to DSN. We needed a lot of help and got it from others in DSN, JPL NAV, and scheduling areas to get the job done. Gave a round of applause to DSN for a job well done <clap, clap>

Change is very certain, especially with the challenging mission profile coming in 2011, we can't do without it. We will need to handle existing missions and help them move forward with the DSN changes. Every mission feels that it is the most important one, each one with specific needs. What has been helpful in the DSN is the continuity in personnel, including NOPEs and DSCCs, Scheduling Teams, MIMs who are knowledgeable.

What can we do as users to help make the job easier on the DSN and help with collaboration and coordination efforts?

Todd Holloway

I am not as experienced with DSN, coming from the human space flight side to work with LRO and LCROSS Launch. Discussed experience in making risk trades across

missions to deal with launch slips, limited resources and options in the flight plans, For eg., a shift in launch times could perturb everything. I was surprised to the extent to which their launch plans stressed the DSN scheduling process. We are moving into a timeframe when we will be integrating the human missions into the DSN, the prioritization strategy will become important to the process. DSN processes and resources will need to be altered to meet the demands.

### Q&A with Audience

Jeff Berner: There is a need for more communication between DSN and the project, early in the mission design phase. Often by the time DSN gets involved, decisions have been made which makes things way more difficult than they need to be. And if some discussion had happened earlier, solutions would have been easier. For example, NEAR's safe mode had a 10 bps data rate with the longest frame size possible, and an emergency situation would have meant over an hour to acquire in safe mode. By the time DSN got involved, it was too late to change frame size on board. Early interaction could have avoided this. Nowadays, more missions are launching in safe mode which makes it significantly easier than having to handle multiple possibilities. Bottom line is that we should have discussion early enough in the mission phase, when the spacecraft design can still be modified. How do we do this?

Gentry Lee: Fundamental idea behind restructuring is that missions will work with the DSN from conception through to implementation, with some degree of continuity of personnel on both sides of the interface. Something we need to do better is to communicate uncertainties, i.e., the degree to which the plans of the mission are solid versus subject to change. For example, DAWN mission's nominal mission profile is very unlikely to occur as planned, because there are so many events which can change what they will do, which in turn will change the timing of their critical events. When the DSN and the missions get together from the beginning, they need to know the range of things and the coefficient of how likely things are apt to change. Some missions and events are fairly predictable, others are not. For eg., when MSL launches is not predictable, but when it does, you can start planning when it will get to Mars (predictable).

Bottom line: Missions and DSN need to share and document some degree that describes how solid are the pre-flight plans and where DSN is going to have to apply its "nimbleness" (aka flexibility) coefficient.

One minute editorial: *The DSN is an international treasure. The history books will record that it **was** the enabler for the golden age of space exploration. It is the responsibility of every one of us in this room to recognize that we must keep that international treasure alive, alert, and solid. Otherwise, none of us who have dreams of exploring the solar system and beyond can possibly do what it is that we want to do.*

Steve Wissler: We don't seem to plan very well for possibilities of extended missions. Not only are there impacts on DSN availability, but we now have 3 spacecraft in the same transponder frequency (DAWN, EPOXI, MER) which can create conflicts in some

cases. More advanced planning is needed especially with mission extensions, but what is the proper forum for these types of conflicting resource issues?

Marcus Watkins – Extensions will always be a reality within NASA. It seems that HQ needs to address these issues when an extended mission is approved. We need better coordination and communication about what is coming, especially for issues that cut across all missions such as spacecraft frequencies.

Jim Adams – NASA Senior Review Process will include SCan in the future, but it is a good point that we will need to look at more than track time when we review extensions.

Rich Burns – If a mission can be extended, it will be. The cost benefits of extending missions is almost always much more cost effective than developing a new spacecraft.

Chad Edwards: Another solution for frequency conflicts is to have spacecraft telecom payloads include the ability to modify downlink frequency over the lifetime of a mission. More generally, being able to re-program these payloads in flight, helps to take advantage of programmatic changes and infuse new technology over the lifetime of these missions.

Dwight Holmes: Missions tend to operate as if they are in isolation and don't talk to the other missions in their design phase, that needs to change. DSN is a network that includes the ground and flight communications equipment on all of the spacecraft, so decisions on frequency, protocols, etc., need to be decided as an integrated network. And, unfortunately, those decisions come after the mission has already decided what they are going to do for their comm. interfaces.

Jim Adams: I would have disagreed with you four years ago when I was working on STEREO but today I can't agree with you more. It is a difference in the perspective of being responsible for the myriad of things that it takes to get these missions flying. We should never lose sight of the fact that we should do early coordination across the agency suite of missions.

Marcus Watkins: The centers have to step up to it, but it's a coordination that needs to occur at each individual center and also again back through headquarters and those respective offices. At GSFC, we are telling projects that they need to engage DSN early on in the process, making sure that they are taking a wide variety of things into account when they are either choosing their communication path and making sure that the DSN is on board. Missions can expect to use the DSN in the future, it will be rare to build new antennas dedicated to a mission.

Mark Holdbridge: To solve tough problems, you always strive to poll the collective intelligence of the team in some sort of forum to work the problem. In the DSN, you see an aggregate summation of the problems that you don't see as an individual project. The end design would benefit from earlier collaboration but there's a challenge to get DSN involved during the design phase. Especially during a competitive phase, there is not much opportunity since people aren't going to share a lot of information sooner than they have to.

Jim Adams: The competitive process adds an interesting constraint to the early coordination process.

Bob Cesarone: How do we establish a process for programmatic advocacy of DSN upgrades on a long-range basis? There is a chicken and egg problem in trying to meet the needs of the future missions. We need the technologies and the capacities to do that but when we make proposals to close the gaps between what we can do and what we need to do, it is viewed as self-serving. We really need advocacy from the missions and yet competing missions won't advocate for it because they know they are going to get tagged with the cost of it and perhaps the missions that should want it are maybe only in formulation phase and don't yet have the wheel base to advocate. And so we tend to work in crisis mode.

Jim Adams: The best approach is to add an ongoing systems engineering function within SCAN, coordinating across missions and the future.

Marcus Watkins: Important to have a coordinated systems engineers would work across the various directorates, looking at the planned missions that are coming down the road.

Todd Holloway: When a project actually starts implementation, they are not thinking about DSN's implementation and upgrades, so it has to happen at a higher level. We need a DSN architecture roadmap that is part of a strategic decision process and funded somewhat independent of the projects. Constellation won't even make a commitment about DSN, but they could become a key driver in the future. We need to keep DSN as an international treasure, it is a strategic asset that we can use to show what our country does and offers the world. We should expect the projects to pop their head up in a turkey shoot and say I need this.

Marcus Watkins: The program office needs to ensure there is continuity and that at every center there is an executive council, that addresses this before going to headquarters for key decision point. It's the responsibility, of each Center to be asking questions about how their missions plan to operate and ensure they are communicating with the DSN before implementation. These discussions need to be going on during the phase A and B, and it is the responsibility for program offices throughout NASA as well as the center executive councils to ensure that these sorts of discussions are taking place.

Todd Holloway: The problem is an aggregate one, since the problem often only shows up when you stack up the requests from multiple missions.

Jim Adams: There is a culture shift if we're going to leave a trail for the future. In the past, for eg., Voyager, we increased the aperture from 64 to 70m when it was a mission with a deep pocket, but today, that is no longer the case and most missions are competed. Thus, SMD and ESMD need to be thinking about advocating with SCAN and SOMD for additional assets, because we are continuing to squeak missions into the margins and the corners of the capability of the DSN. Even JWST is trying to avoid getting a bill associated with the

Neil Mottinger: Chandrayaan used the DSN as an international asset. We need to continue to have our international partners folded into this process.

Jim Adams: We have a paradigm shift at HQ and we are soliciting ideas on how to change the way we partner with international agencies. It would be a disappointing day if we did not include the DSN services as part of our international agreements in the future. When somebody wants to go into space, that is an accomplishment for human kind and we need to feel a part of that by supporting it somehow.

Susan Kurtik: The APL station was used to support Chandrayaan and LCROSS missions as an extension of the DSN and was a unique opportunity for Dan Ossing (STEREO mission manager) to walk in both DSN and Mission moccasins. To Dan - what was it like?

Dan Ossing: The CH1/LCROSS experience gave them an opportunity to be on both sides of the fence. It turned out to be much more difficult to keep their station going 24x7 for a deep space mission. We had used the station periodically for some low-earth orbiting missions but never at this level. We learned it requires quite a bit more resources than you can allocate to it and you need some very dedicated personnel. If HQ can free up assets to give to the DSN, they're going to put it to good use.

Rich Benson: We've heard a lot about the need for a closer marriage and close coordination to manage the different kinds of missions and events and to help make it all fit. What about an operations concept based on the use of standard services, based on a plug and play approach for invoking the link. Is it most important to have a better understanding of the range of options of things that might happen or is our ability to respond quickly to short fuse, defined changes another way to deal with things? Is closer coordination of the scenarios likely to pay off or practicing up on a more standard way to invoke responses to ever-changing conditions?

Mark Holdbridge: The developers of ground systems that interface with the DSN are a big fan of the standards because it helps promote reuse and cuts costs/risk/schedule. Standard services is also a win-win for operations, since there is less testing and training required for the next mission. The emergency/contingency situations during operations should be the exception, not the norm. We keep talking about the projects have their blinders on, since they're trying to get their mission built and launched and operated with limited funds. The DSN has this aggregate set of users and demands on it and must interface with all these projects and run things past them and have meetings like this. And I'm wondering if there's not a larger role for the centers, collaborating to define new services or new standards and then they would design their mission systems to follow those standards. There is a missing link in the way we do things right now.

Rich Burns: At GSFC, we prefer standard services because we have missions that do the same thing over and over again. But we want to be able to talk to people; we want to build relationships that we can reach out to people when special circumstance is warranted. Finding the right combination of those things is, I think, the challenge in where we need to work together to arrive at the right conclusion.

Todd Holloway: Standards have to be standard. It is important that as standards are defined, they are not just standard on paper but are actually standard across interfaces.

Jim Adams: HQ AO's should encourage each center to evaluate any mission proposal on its responsible use of the DSN, it is in the evaluation criteria. This is usually secondary in the selection process but that might need to be changed as we go through phase B when there is an opportunity for HQ and the DSN to get an idea of what's going on. But it won't be a discriminator if there is something nonstandard. We may end up either budgeting to fix it or change the mission downstream at some point.

Rich Burns: I'd like to pose a question to the DSN. We've heard that the upcoming years are going to be challenging. Do we have any estimates about, at least nominally or in worst case scenarios, what might suffer as a consequence and to what extent?

Al Bhanji: This is why we're starting now, because we must understand each other well for the intense activities in 2011-2012. We will have to figure out how we're going to triage these things because it is unique, and we will have to work in partnership. We are doing some early work on the antennas to increase reliability, but we need the missions' help so that we can get the downtime to do this maintenance early. And delays are only going to hurt us later. If you want a reliable service, we need the missions to help us.

Jim Adams: We, meaning everybody in this room, must have an enabling mindset. And so, if you have an extra track available, you give it to a mission because an unused track is possibly science that could be accomplished. Well what that does is that tends to lead to an entitlement program for missions. The gas always expands to fill the void and what we tend to do is lose sight of the commitment that we made originally to mission xyz for one track every other day for four years. And so when, in year two, they're starting to get a track a day or two tracks a day simply because it's available and then you want to take an antenna down for maintenance. It suddenly becomes a federal case. SMD, and possibly SCAN can help, is to document what the commitment really is at the outset, in terms of full mission success and minimum mission success. These missions do incredible things and it's because you're willing to be an enabler rather than a stick in the mud. And at some point we're going to get into this asset contention period part two where it is going to be almost impossible to provide that sort of entitlement to the missions that have been reaping the benefit of our enabling attitude.

Question: Is there a perceived need for the DSN to make sure that affected flight projects, as well as the centers, understand the capabilities current and planned for the deep space network?

Jim Adams: You can never stop educating because there's always going to be the next hotshot deputy project manager that thinks he absolutely has to have the attenuator stuck into those apertures.

Mark Holdbridge: What has been communicated is that there's a problem and there's a potential for individual projects to be affected but what hasn't been communicated is in what way they're going to be affected. If you look at the list of events, there's some elements that are going to happen according to plan. But there are others such as launches with potential slips (3 launches in three months in 2011). When STEREO was

slipping, it was killing everybody. And the lead time on the scheduling was down to a week and could not understand how the other projects were even dealing with it.

Mark Holdbridge: Somebody needs to look at the scenario for the nominal case, and then throw in the more likely faults that are most catastrophic and that dialogue has not even begun yet at HQ

Todd Holloway: I know the centers don't really know much about what's going on with the DSN, the future plans, the implications to it.